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Title: Water Quality Assessment for the Development of Total Maximum Daily Loads for Dissolved Oxygen and Ammonia-Nitrogen in Little Pigeon Creek in Spencer County

Sample Matrix: Water (X); Sediment ( ); Fish Tissue ( )

Location: Ohio River Basin

Hydrologic Unit Code: 05140201

Author and Title: Jennifer Hutchison, Environmental Scientist III

Abstract or Summary:
The purpose of this study is to assess the water quality of Little Pigeon Creek for dissolved oxygen and ammonia-nitrogen. Little Pigeon Creek is on the 303(d) List of Impaired Waterbodies for dissolved oxygen and ammonia-nitrogen. On the first sampling event, two dissolved oxygen violations occurred. The first violation occurred at site OLP140-0018 with a dissolved oxygen value of 3.84 mg/L, which violates the 4.00 mg/L dissolved oxygen water quality standard. The second violation occurred at OLP140-0009 with a dissolved oxygen value of 4.58 mg/L, which violates the 5.00 mg/L dissolved oxygen water quality standard. There was also an ammonia-nitrogen violation at site OLP140-0009 with an ammonia-nitrogen value of 1.00 mg/L, which violates the 0.87 mg/L ammonia-nitrogen water quality standard. However, on the first sampling event OLP140-0009, which had both a dissolved oxygen violation and an ammonia-nitrogen violation, was pooling and not flowing into Little Pigeon Creek. The second and third sampling events had no dissolved oxygen or ammonia-nitrogen violations at any of the sites. It is recommended based on this data that further sampling in the early summer months be performed around site OLP140-0018 to determine if Little Pigeon Creek is actually impaired for dissolved oxygen at that site. It is also recommended that since the 5 sites located on Little Pigeon Creek did not show an ammonia-nitrogen impairment, the ammonia-nitrogen parameter be delisted from Little Pigeon Creek on the 303(d) List of Impaired Waterbodies.

Keywords: TMDL, Little Pigeon Creek, dissolved oxygen, ammonia-nitrogen

Availability: Hard Copy and Electronic Format

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By: Jennifer Hutchison
Environmental Scientist
Environmental Toxicology and Chemistry Section
Assessment Branch, Office of Water Quality
(317) 308-3142
jhutchis@dem.state.in.us

Indiana Department of Environmental Management
100 N. Senate Avenue
P.O. Box 6015
Indianapolis, IN 46206-6015

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Introduction

The IDEM 1998 303(d) list of impaired waterbodies lists the Little Pigeon Creek stream reach near Dale as being impaired for dissolved oxygen and ammonia-nitrogen. According to the 1994-95 Indiana 305 (b) Report, the Dale municipal wastewater treatment plant (WWTP) was the probable source of the low dissolved oxygen and the high ammonia concentrations in Little Pigeon Creek. The Dale wastewater treatment plant discharges to Ballard Branch, which is a tributary of Little Pigeon Creek.

Methods

A. Sampling Sites and Locations

Seven sites for Little Pigeon Creek were sampled. Five sites were chosen on Little Pigeon Creek. The remaining two sites were chosen on the tributaries of Ballard Branch and Unnamed Tributary before they entered into Little Pigeon Creek. These sites were chosen to represent all sources that could be attributing to the impairment of Little Pigeon Creek. See Figure 1.

B. Sample Collection

A presurvey was first completed on May 24, 2000 to determine if the sites proposed could be sampled. All of the proposed sites were approved to be sampled. Three sampling events took place on June 14, 2000, August 2, 2000, and October 12, 2000. These sites were sampled as two part composites over a twenty-four hour period. Samples were collected at each site during each event in late afternoon, 2:00 p.m.-5:00 p.m. and early morning, 2:00 a.m.-5:00 a.m. The samples were collected using a stainless steel bucket dropped over a bridge. Ammonia-nitrogen samples were collected in 1000 mL plastic round neck bottles, preserved with Sulfuric Acid, and sent to Indiana State Department of Health Lab for analysis. The dissolved oxygen was measured using a YSI™, multiparameter data sonde out in the field. On last sampling event, general chemistry and nutrients were collected and flow was measured for modeling purposes. General chemistry and nutrient samples were collected in 1000 mL plastic round neck bottles. Nutrients were preserved with Sulfuric Acid. General Chemistry and Nutrient samples were also sent to Indiana State Department of Health Lab for analysis.

C. Field Measurements

Field parameters were measured at each site during each sampling event using the YSI™, multiparameter data sonde as stated in the work plan. These parameters included pH, water temperature, specific conductivity, turbidity, percent saturation, chloride, and chlorophyll. Field calibration was completed for dissolved oxygen, using a Winkler Test, and pH using a Hach pH meter. Weather conditions, wind strength, air temperature, and cloud conditions were also noted at each site for each sampling event.

D. Protocol Deviations

The first deviation occurred after a presurvey was completed. Many sites were dropped after the presurvey. The following table lists the sites and explanation of why each site was dropped:

Site ID #	Explanation
95-02 (OLP140-0011)	Could not access site
95-01	Scaled back sampling effort due to a change from TMDL Survey to Assessment Survey
95-06	Scaled back sampling effort due to a change from TMDL Survey to Assessment Survey
95-05	Scaled back sampling effort due to a change from TMDL Survey to Assessment Survey
95-04	Scaled back sampling effort due to a change from TMDL Survey to Assessment Survey
95-12 (OLP140-0016)	Scaled back sampling effort due to a change from TMDL Survey to Assessment Survey
95-13 (OLP140-0015)	Scaled back sampling effort due to a change from TMDL Survey to Assessment Survey
95-14 (OLP140-0013)	Scaled back sampling effort due to a change from TMDL Survey to Assessment Survey
95-15 (OLP140-0012)	Scaled back sampling effort due to a change from TMDL Survey to Assessment Survey

Due to the inability to access site OLP140-0011, site OLP140-0018 was added to account for a site on Little Pigeon Creek before the waster water treatment plant.

Two deviations occurred in the work plan after the first sampling event. The first deviation occurred in the second sampling event when an additional site, OLP140-0019, was added further upstream. This site was added due to a dissolved oxygen violation on OLP140-0018. OLP140-0019 was added to confirm if the cause of the violation occurred further upstream or at that site. After the second sampling event was over, OLP140-0019 was found to have no dissolved oxygen violation. This concluded that the impairment was not occurring further upstream.

The second deviation occurred on the third sampling event. This deviation involved OLP140-0010 and OLP140-0009 that were on the tributaries. These two sites were dropped on the last run because they showed no signs of contributing to the violation of dissolved oxygen or ammonia-nitrogen on the first two sampling events. Only the sites located on Little Pigeon Creek were sampled.

Results

A. Field Data

All field data collected was collected using a YSI™. The YSI™ was calibrated by IDEM staff and was field checked according to the workplan. All of the field data was found to be valid. See Table 1 for field data results.

B. Dissolved Oxygen

Dissolved oxygen concentrations shall average at least 5.0 mg/L per calendar day and shall not be less than 4.0 mg/L at any time (327 IAC 2-1-6.) On the first sampling event, OLP140-0018 had dissolved oxygen of 3.84 mg/L, which violated the minimum dissolved oxygen standard. Also on the first sampling event, OLP140-0009 had mean dissolved oxygen of 4.58 mg/L which violated the mean dissolved oxygen standard. However, OLP140-0009 was not flowing to Little Pigeon Creek and the sample was taken from a pool. The remaining dissolved oxygen values met dissolved oxygen water quality standards. See Table 2 for dissolved oxygen data results.

C. Ammonia-Nitrogen

The ammonia-nitrogen water quality standards are based on a relationship between temperature and pH (327 IAC 2-1-6.) Since the IDEM staff collected temperature and pH over a 24-hour period, the temperature and pH were averaged to create a mean temperature and a mean pH. The means were then used to calculate what the ammonia-nitrogen value should be at that temperature and pH. The sample collected at each site was then compared to the calculated ammonia-nitrogen value. OLP140-0009 was the only site that did not meet the ammonia-nitrogen water quality standard. However, this site was not flowing to Little Pigeon Creek at the time the violation occurred. See Table 3 for ammonia-nitrogen data results.

D. General Chemistry and Nutrients

All general chemistry and nutrient results were evaluated either on numeric water quality standards (327 IAC 2-1-6) or by a comparison with those parameters collected by other IDEM employees in that area. All general chemistry and nutrients results were found to be in acceptable range except for C.O.D. These results are estimated due to field blank contamination. See Table 4 for general chemistry and nutrient data results.

E. Field Observations

All of the sampling events took place during low flow as stated in the workplan. All of the sites sampled on Little Pigeon Creek had cornfields on both banks. The fields either did not have buffer strips or very narrow ones. Aquatic life was present at some of the sites. This included turtles, fish, minnows, and snakes. On the first sampling event, OLP140-0009 was not flowing into Little Pigeon Creek, but a sample was still taken. On the other two sampling events, the Unnamed Tributary was flowing to Little Pigeon Creek. On the first sampling event, the sample for OLP140-0018 was taken from a stagnant pool. On the last sampling event, lily pads were observed at OLP140-0017 and heavy algae was observed at OLP140-0018.

Discussion

OLP140-0018 violated the dissolved oxygen Water Quality Standard. However in the second and third sampling event, this site met dissolved oxygen Water Quality Standards. The Chemical Oxygen Demand (C.O.D) and Biological Oxygen Demand (B.O.D) results showed no Water Quality Standard violations or potential problems. The sample for the first sampling event was collected from a stagnant pool, which could account for the low dissolved oxygen.

OLP140-0009 on the first sampling event had violations for dissolved oxygen and for ammonia-nitrogen. However, OLP140-0009 was not flowing into Little Pigeon Creek at this time. The sampling was taken from a pool on the first sampling event and further sampling events the sample was taken from a run. The C.O.D and B.O.D results taken on the third sampling event were not above average. OLP140-0009 did not have any violations on the second or third sampling events, when it was flowing to Little Pigeon Creek.

All the ammonia-nitrogen data collected was valid and no ammonia-nitrogen violations occurred on Little Pigeon Creek on any of the three sampling events.

Recommendations

- Since the dissolved oxygen violation did not occur further upstream or downstream of OLP140-0018, further observation of this site needs to be completed to determine what is causing the dissolved oxygen violation. The second and third sampling events were completed in the late summer and early fall and showed no dissolved oxygen violations for OLP140-0018. It is also recommended that further sampling be done during the early summer months, since the violation occurred on the first sampling event, to see if the dissolved oxygen violation occurs again.

- Since there were no violations for dissolved oxygen and ammonia-nitrogen when the Unnamed Tributary was flowing to Little Pigeon Creek, it is recommended that the Unnamed Tributary should not be considered as being impaired or causing an impairment on Little Pigeon Creek.

- Since there were no ammonia-nitrogen violations found on Little Pigeon Creek it is recommended that the ammonia-nitrogen parameter be removed from the 303 (d) list of Impaired Water Bodies of Indiana.

Table 1: Standard Field Data for Little Pigeon Creek

First Sampling Event:

Site ID #	Stream Name	Description	Sample Number	Sample Date	Sample Time	Dissolved Oxygen (mg/L)	pH	Water Temp (^{o}C)	Specific Conductivity (uS/cm)	Turbidity (NTU)	Chlorine (mg/L)	Chloride (mg/L)	Chlorophyll (mg/L)	Saturation %
OLP140-0018	Little Pigeon Creek	550 East	AA00172	6/13/00	2:50:00 PM	7.82	7.67	31.67	726	140		12.7	5.9	106.6
OLP140-0018	Little Pigeon Creek	550 East	AA00172	6/14/00	2:30:00 AM	3.84	7.25	26.23	736	168		14.3	5	47.3
OLP140-0008	Little Pigeon Creek	CR 350 E	AA00170	6/13/00	2:30:00 PM	8.7	8.12	30.64	759	35.5		67.59	4	116.9
OLP140-0008	Little Pigeon Creek	CR 350 E	AA00170	6/14/00	2:05:00 AM	4.8	7.45	24.87	377	24.6		76	3.9	61.3
OLP140-0017	Little Pigeon Creek	CR 300 E (Lincoln Rd)	AA00173	6/13/00	3:07:00 PM	11.07	8.89	30.29	791	33		56.1	3.6	147.7
OLP140-0017	Little Pigeon Creek	CR 300 E (Lincoln Rd)	AA00173	6/14/00	2:45:00 AM	7.8	7.95	26.16	12	65.5		47.35	3.3	89.7
OLP140-0014	Little Pigeon Creek	US 231	AA00174	6/13/00	3:24:00 PM	8.05	8.31	31.54	839	18.3		50	2.3	109.5
OLP140-0014	Little Pigeon Creek	US 231	AA00174	6/14/00	3:00:00 AM	5.29	7.54	25.35	839	11.4		59.1	3.1	60.6
OLP140-0010	Ballard Branch	CR 1800 N	AA00169	6/13/00	2:00:00 PM	8.03	8.62	30.31	648	12.8		79.3	15.9	107.6
OLP140-0010	Ballard Branch	CR 1800 N	AA00169	6/14/00	2:00:00 AM	7.93	7.67	27.17	646	36.4		81.7	4.9	99.2
*OLP140-0009	Unnamed Trib, Little Pigeon Cr	CR 350 E	AA00171	6/13/00	2:35:00 PM	4.82	7.43	26.56	774	85		15.2	4.6	61.7
*OLP140-0009	Unnamed Trib, Little Pigeon Cr	CR 350 E	AA00171	6/14/00	2:10:00 AM	4.34	7.38	22.98	769	465.8		18.29	8.2	50.8

*Pooling and not flowing to Little Pigeon Creek;not influencing Little Pigeon Creek

Table 1 (continued)

Second Sampling Event:

Site ID #	Stream Name	Description	Sample Number	Sample Date	Sample Time	Dissolved Oxygen (mg/L)	pH	Water Temp (oC)	Specific Conductivity (uS/cm)	Turbidity (NTU)	Chlorine (mg/L)	Chloride (mg/L)	Chlorophyll (mg/L)	Saturation %
OLP140-0019	Little Pigeon Creek	SR 245	AA01006	8/1/00	3:25:00 PM	7.85	7.8	28.74	552	7.9		11.5	-7.5	102.7
OLP140-0019	Little Pigeon Creek	SR 245	AA01006	8/2/00	2:50:00 AM	6.26	7.29	23.83	548	8.2		16.87	-7	74.1
OLP140-0018	Little Pigeon Creek	550 East	AA01005	8/1/00	3:10:00 PM	9.95	8.38	30.37	622	10		15.62	-7.3	130.8
OLP140-0018	Little Pigeon Creek	550 East	AA01005	8/2/00	2:35:00 AM	4.61	7.25	23.02	630	16.9		19.89	-7.4	53.9
OLP140-0008	Little Pigeon Creek	CR 350 E	AA01002	8/1/00	2:49:00 PM	8.49	8.15	29.3	589	14.9		27.05	-6.2	111.7
OLP140-0008	Little Pigeon Creek	CR 350 E	AA01002	8/2/00	2:10:00 AM	5.97	7.47	23.67	582	21.7		36.33	-5.4	71.6
OLP140-0017	Little Pigeon Creek	CR 300 E (Lincoln Rd)	AA01007	8/1/00	3:35:00 PM	8.21	8.12	30.47	497	22.2		29.22	-6	109.9
OLP140-0017	Little Pigeon Creek	CR 300 E (Lincoln Rd)	AA01007	8/2/00	3:05:00 AM	6.1	7.4	24.1	539	35		32.91	-4.3	72.7
OLP140-0014	Little Pigeon Creek	US 231	AA01008	8/1/00	3:50:00 AM	7.16	7.43	27.72	490	10.7		35.7	-3.9	91.3
OLP140-0014	Little Pigeon Creek	US 231	AA01008	8/2/00	3:20:00 AM	5.5	7.22	23.76	496	18.3		46.99	-6.6	64.5
OLP140-0010	Ballard Branch	CR 1800 N	AA01001	8/1/00	2:30:00 PM	7.33	7.67	28.97	461	21.4		41.01	-6.8	96
OLP140-0010	Ballard Branch	CR 1800 N	AA01001	8/2/00	1:55:00 AM	6.06	7.38	25.54	477	125.2		54.27	-4.1	74
*OLP140-0009	Unnamed Trib, Little Pigeon Cr	CR 350 E	AA01003	8/1/00	2:55:00 PM	8.2	8.14	28.93	470	20.2		17	-4.1	106
*OLP140-0009	Unnamed Trib, Little Pigeon Cr	CR 350 E	AA01003	8/2/00	2:20:00 AM	6.42	7.58	23.64	482	23.1		22.53	-5.9	75.7

* Appears to be flowing to Little Pigeon Creek

Table 1 (continued)

Third Sampling Event:

Site ID #	Stream Name	Description	Sample Number	Sample Date	Sample Time	Dissolved Oxygen (mg/L)	pH	Water Temp (oC)	Specific Conductivity (uS/cm)	Turbidity (NTU)	Chlorine (mg/L)	Chloride (mg/L)	Chlorophyll (mg/L)	Saturation %
OLP140-0019	Little Pigeon Creek	SR 245	AA02444	10/11/00	2:10:00 PM	11.33	7.91	13.11	828	4.6		21.46	1.7	108.3
OLP140-0019	Little Pigeon Creek	SR 245	AA02444	10/12/00	2:05:00 AM	10.74	7.68	10.19	829	4.2		31.01	2.9	95.9
OLP140-0018	Little Pigeon Creek	550 East	AA02446	10/11/00	2:55:00 PM	12.63	7.95	13.25	833	5.6		29.32	2.9	120.9
OLP140-0018	Little Pigeon Creek	550 East	AA02446	10/12/00	2:30:00 AM	10.44	7.59	9.18	845	15.4		38.37	1.9	90.5
OLP140-0008	Little Pigeon Creek	CR 350 E	AA02447	10/11/00	3:35:00 PM	11.38	7.96	14.49	899	13.6		46	2	112.2
OLP140-0008	Little Pigeon Creek	CR 350 E	AA02447	10/12/00	2:55:00 AM	11.34	7.71	9.22	919	20.7		51.45	2.7	98.2
OLP140-0017	Little Pigeon Creek	CR 300 E (Lincoln Rd)	AA02448	10/11/00	4:10:00 PM	11.94	7.78	13.38	877	12.8		47.85	1.5	114.6
OLP140-0017	Little Pigeon Creek	CR 300 E (Lincoln Rd)	AA02448	10/12/00	3:15:00 AM	11.19	7.65	10.32	885	21.2		58.69	3.2	99.1

Table 2: Diurnal Dissolved Oxygen Values for Little Pigeon Creek (Afternoon: 2:00 pm-5:00 pm, Morning: 2:00 am-5:00 am)

First Sampling Event:

						DO (mg/L)			DO WQS (mg/L)		WQS Violation	
Site ID #	Stream Name	Site Info	Start Date	End Date	IDEM #	Afternoon	Morning	Mean	Minimum	Mean	Minimum	Mean
OLP140-0018	Little Pigeon Creek	CR 550 E	6/13/00	6/14/00	AA00172	7.82	3.84	5.83	4.00	5.00	**YES**	NO
OLP140-0008	Little Pigeon Creek	CR 350 E	6/13/00	6/14/00	AA00170	8.70	4.80	6.75	4.00	5.00	NO	NO
OLP140-0017	Little Pigeon Creek	Lincoln Road	6/13/00	6/14/00	AA00173	11.07	7.80	9.44	4.00	5.00	NO	NO
OLP140-0014	Little Pigeon Creek	US 231	6/13/00	6/14/00	AA00174	8.05	5.29	6.67	4.00	5.00	NO	NO
OLP140-0010	Ballard Branch	CR 1800 N	6/13/00	6/14/00	AA00169	8.03	7.93	7.98	4.00	5.00	NO	NO
*OLP140-0009	Unnamed Tributary	CR 350 E	6/13/00	6/14/00	AA00171	4.82	4.34	4.58	4.00	5.00	NO	**YES**

Second Sampling Event:

						DO (mg/L)			DO WQS (mg/L)		WQS Violation	
Site ID #	Stream Name	Site Info	Start Date	End Date	IDEM #	Afternoon	Morning	Mean	Minimum	Mean	Minimum	Mean
OLP140-0019	Little Pigeon Creek	SR 245	8/1/00	8/2/00	AA01006	7.85	6.26	7.06	4.00	5.00	NO	NO
OLP140-0018	Little Pigeon Creek	CR 550 E	8/1/00	8/2/00	AA01005	9.95	4.61	7.28	4.00	5.00	NO	NO
OLP140-0008	Little Pigeon Creek	CR 350 E	8/1/00	8/2/00	AA01002	8.49	5.97	7.23	4.00	5.00	NO	NO
OLP140-0017	Little Pigeon Creek	Lincoln Road	8/1/00	8/2/00	AA01007	8.21	6.10	7.16	4.00	5.00	NO	NO
OLP140-0014	Little Pigeon Creek	US 231	8/1/00	8/2/00	AA01008	7.16	5.50	6.33	4.00	5.00	NO	NO
OLP140-0010	Ballard Branch	CR 1800 N	8/1/00	8/2/00	AA01001	7.33	6.06	6.70	4.00	5.00	NO	NO
OLP140-0009	Unnamed Tributary	CR 350 E	8/1/00	8/2/00	AA01003	8.20	6.42	7.31	4.00	5.00	NO	NO

Third Sampling Event:

						DO (mg/L)			DO WQS (mg/L)		WQS Violation	
Site ID #	Stream Name	Site Info	Start Date	End Date	IDEM #	Afternoon	Morning	Mean	Minimum	Mean	Minimum	Mean
OLP140-0019	Little Pigeon Creek	SR 245	10/11/00	10/12/00	AA02444	11.33	10.74	11.04	4.00	5.00	NO	NO
OLP140-0018	Little Pigeon Creek	CR 550 E	10/11/00	10/12/00	AA02446	12.63	10.44	11.54	4.00	5.00	NO	NO
OLP140-0008	Little Pigeon Creek	CR 350 E	10/11/00	10/12/00	AA02447	11.38	11.34	11.36	4.00	5.00	NO	NO
OLP140-0017	Little Pigeon Creek	Lincoln Road	10/11/00	10/12/00	AA02448	11.94	11.19	11.57	4.00	5.00	NO	NO

* Pooling and not flowing to Little Pigeon Creek; not influencing Little Pigeon Creek

Table 3: Ammonia-Nitrogen Values for Little Pigeon Creek

First Sampling Event:

Site ID #	Stream Name	Site Info	Date	Site ID #	IDEM #	PM pH	AM pH	PM Temp (°C)	AM Temp (°C)	Mean pH	Mean Temp (°C)	Table	NH3-N CCC	Sample NH3-N (mg/L)	WQS Violation?
OLP140-0018	Little Pigeon Creek	CR 550 E	6/13/00	6/14/00	AA00172	7.67	7.25	31.67	26.23	7.5	29	0.0153	0.72	0.10	NO
OLP140-0008	Little Pigeon Creek	CR 350 E	6/13/00	6/14/00	AA00170	8.12	7.45	30.64	24.87	7.8	28	0.0260	0.64	0.20	NO
OLP140-0017	Little Pigeon Creek	Lincoln Road	6/13/00	6/14/00	AA00173	8.89	7.95	30.29	26.16	8.4	28	0.0294	0.19	0.10	NO
OLP140-0014	Little Pigeon Creek	US 231	6/13/00	6/14/00	AA00174	8.31	7.54	31.54	25.35	7.9	28	0.0276	0.48	0.10	NO
OLP140-0010	Ballard Branch	CR 1800 N	6/13/00	6/14/00	AA00169	8.62	7.67	30.31	27.17	8.1	29	0.0294	0.31	0.10	NO
*OLP140-0009	Unnamed Tributary	CR 350 E	6/13/00	6/14/00	AA00171	7.43	7.38	26.56	22.98	7.4	25	0.0122	0.87	1.00	**YES**

Second Sampling Event:

Site ID #	Stream Name	Site Info	Date	Site ID #	IDEM #	PM pH	AM pH	PM Temp (°C)	AM Temp (°C)	Mean pH	Mean Temp (°C)	Table	NH3-N CCC	Sample NH3-N (mg/L)	WQS Violation?
OLP140-0019	Little Pigeon Creek	SR 245	8/1/00	8/2/00	AA01006	7.80	7.29	28.74	23.83	7.5	26	0.0153	0.72	0.10	NO
OLP140-0018	Little Pigeon Creek	CR 550 E	8/1/00	8/2/00	AA01005	8.38	7.25	30.37	23.02	7.8	27	0.0260	0.65	0.10	NO
OLP140-0008	Little Pigeon Creek	CR 350 E	8/1/00	8/2/00	AA01002	8.15	7.47	29.30	23.67	7.8	26	0.0262	0.66	0.10	NO
OLP140-0017	Little Pigeon Creek	Lincoln Road	8/1/00	8/2/00	AA01007	8.12	7.40	30.47	24.10	7.8	27	0.0260	0.70	0.10	NO
OLP140-0014	Little Pigeon Creek	US 231	8/1/00	8/2/00	AA01008	7.43	7.22	27.72	23.76	7.3	26	0.0097	0.78	0.20	NO
OLP140-0010	Ballard Branch	CR 1800 N	8/1/00	8/2/00	AA01001	7.67	7.38	28.97	25.54	7.5	27	0.0153	0.70	0.20	NO
OLP140-0009	Unnamed Tributary	CR 350 E	8/1/00	8/2/00	AA01003	8.14	7.58	28.93	23.64	7.9	26	0.0276	0.64	0.20	NO

Third Sampling Event:

Site ID #	Stream Name	Site Info	Date	Site ID #	IDEM #	PM pH	AM pH	PM Temp (°C)	AM Temp (°C)	Mean pH	Mean Temp (°C)	Table	NH3-N CCC	Sample NH3-N (mg/L)	WQS Violation?
OLP140-0019	Little Pigeon Creek	SR 245	10/11/00	10/12/00	AA02444	7.91	7.68	13.11	10.19	7.8	12	0.0260	1.99	0.10	NO
OLP140-0018	Little Pigeon Creek	CR 550 E	10/11/00	10/12/00	AA02446	7.95	7.59	13.25	9.18	7.8	11	0.0260	2.18	0.10	NO
OLP140-0008	Little Pigeon Creek	CR 350 E	10/11/00	10/12/00	AA02447	7.96	7.71	14.49	9.22	7.8	12	0.0260	1.79	0.10	NO
OLP140-0017	Little Pigeon Creek	Lincoln Road	10/11/00	10/12/00	AA02448	7.78	7.65	13.38	10.32	7.7	12	0.0242	2.19	0.10	NO

*Pooling, not flowing to Little Pigeon Creek

Table 4: General Chemistry and Nutrient Values for Little Pigeon Creek

Parameters	Sites			
	1 OLP140-0019	2 OLP140-0018	3 OLP140-0008	4 OLP140-0017
Alkalinity (mg/L)	67	69	80	78
Hardness (mg/L)	178	189	180	169
Nitrate-Nitrite-N (mg/L)	2.9	3.2	5.1	6.4
T.K.N (mg/L)	0.3	0.3	0.3	0.5
Total Phosphorus (mg/L)	<0.03	<0.03	0.26	0.23
Ortho. Phosphorus (mg/L)	<0.03	<0.03	0.23	0.18
* C.O.D. (mg/L)	13.5	13.9	12.7	16.2
T.O.C (mg/L)	2.9	2.8	3.0	2.9
C-B.O.D. (mg/L)	<1.0	<1.0	<1.0	<1.0
Total Solids (mg/L)	321	322	342	340
Total Suspended Solids (mg/L)	5.0	6.0	10.0	10.0
Total Dissolved Solids (mg/L)	303	307	327	329
Chloride (mg/L)	11.0	15.0	25.0	26.0
Sulfate (mg/L)	120.0	110.0	98.0	105.0

* C.O.D. data was rejected due to contamination of the field blank.
However the data for the sites meet Water Quality Standards.

Figure 1: Dissolved Oxygen and Ammonia-Nitrogen Violation Status Map for Little Pigeon Creek